detecting coils is used to sense the tone current travelling along the cable. The strength of the received signal is directly proportional to the magnitude of the tone current in the cable sheath directly below the receiver.

The transmission circuit for the tone ~~signals~~ current is formed by the metal armour or shield and insulated by the plastic cable jacket from earth which forms the return conductor. The circuit is basically a coaxial transmission path with the insulated cable armour forming the inner conductor and the surrounding earth forming the outer conductor.

**The paragraph bridging pages 1 and 2, page 1, paragraph 5, lines 24 to 26 and page 2, paragraph 1, lines 1 to 8, insert the following paragraph.**

The tone current must be present on all segments of a cable at a level greater than the minimum current dictated by the receiver sensitivity. This requires a termination at the end of the cable to draw at least the minimum amount of current. A distribution cable typically has a number of branch cables which must also draw enough tone current for cable locating. Since the ~~tone~~ current is heavily attenuated by the cable, the terminations near the source will ~~load~~ draw a much higher ~~signal~~ current level than the distant terminations. To compensate for this, most installations use terminators with different signal load impedances for near, middle and far terminations. In addition to the inconvenience of using ~~plural~~ different impedances for different terminations, the known systems require recalculation and replacement of the terminators when an additional branch is connected.

**Page 2, paragraph 2, lines 9 to 10 insert the following paragraph:**

Where a cable is damaged, the ~~tone signal~~ current level may fall below the

minimum, making it difficult or impossible to locate the damaged cable.

**Page 2, paragraphs 4 to 8, lines 14 to 23 delete the following paragraphs:**

~~According to one aspect of the present invention there is provided a constant current termination for cable locating tones, comprising:~~

~~a first terminal for connection to a tone conductor of a cable to be terminated;~~

~~a second terminal to be connected to a tone signal return path;~~

~~a load impedance connected between the first and second terminals; and~~

~~an active component responsive to variations in a voltage between the first and second terminals to vary the magnitude of the load impedance to maintain a substantially constant current through the load impedance.~~

**The paragraph bridging pages 2 and 3, page 2, paragraph 9, lines 24 to 26 and page 3, paragraph 1, lines 1 to 13, insert the following paragraph.**

According to ~~another~~ <u>one</u> aspect of the present invention there is provided a tone locating system for a cable installation having a backbone cable, a plurality of branch cables, splices coupling the branch cables to the backbone cable and tone conductors along the backbone and branch cables, the tone conductors being connected at the splices, the locating system comprising:

a tone source connected to the tone conductor of the backbone cable at an inner end of the backbone cable;

a plurality of terminations connected to the respective tone conductors at ends thereof remote from the tone source and the splices, each termination comprising:

a load impedance connected to the respective tone conductor and to a tone signal return path; and

an active component responsive to variations in a voltage between the respective tone conductor and the return path to vary the magnitude of the load impedance to maintain a substantially constant current through the load impedance.

**The paragraph bridging pages 3 and 4, page 3, paragraph 7, lines 22 to 26 and page 4, paragraph 1, lines 1 to 12, insert the following paragraph.**

In a preferred embodiment of the present invention, the termination circuit has an input terminal for connection to the tone conductor of the cable and an output terminal for connection to a ground return path. A ~~lighting~~ lightning protection device, e.g. a gas tube surge suppresser, a MOV or both, bridges the two terminals. A ~~I~~ high pass filter is connected in series with the ~~lighting~~ lightning protection to block low frequencies used by either equipment on the same cable conductor. Also in series with the ~~lighting~~ lightning protection and the high pass filter is a band stop filter for filtering induced mains frequency signals. The signal thus processed is delivered to a rectifier, the output of which is connected to a series circuit including the load resistor and a variable impedance, which is in the preferred embodiment the drain to source path of a field effect transistor (FET). The gate and source of the FET are connected across the load resistor. The FET regulates the gate - source voltage and therefore the current draw of the load resistor. A high frequency bypass filter bridges the source and drain terminals of the FET to prevent ringing since the FET may turn on and off very quickly around the current limit with very large input ~~tones~~ currents. A zener diode is connected in parallel with the load resistance to prevent damage to the FET from input surges.

**Page 5, paragraphs 1 to 5, lines 1 to 16 insert the following paragraphs:**

~~20.~~ According to another aspect of the invention there is provided a method of providing a controlled signal current on each of a backbone cable with inner and outer ends and a signal conductor from the inner end to the outer end and a plurality of branch cables with respective inner and outer ends and with the inner ends spliced to the backbone cable, each of the branch cables having a signal conductor spliced at the inner end of the branch cable to the signal conductor of the backbone cable, the method comprising:

applying an electrical signal to the signal conductor at the inner end of the backbone cable;

providing resistive terminations at the outer end of the backbone cable and at the outer end of each branch cable, connecting the signal conductor to a signal return path;

monitoring the electrical signal at each termination; and

maintaining a substantially constant electrical signal current at each termination by varying the resistive termination in response to variations in the electrical signal at the termination.

**The paragraph bridging pages 5 and 6, page 5, paragraph 10, line 26 and page 6, paragraph 1, lines 1 to 5, insert the following paragraph.**

Referring to the accompanying drawings Figure 1 illustrate a cable system 10 that includes a backbone cable 12 and branch cables 14. Each of these cables has a core 16, a metallic armour 18 surrounding the core and a plastic material outer jacket 20. The branch cables 14 are connected to the backbone cable ~~and~~ at splices 22. In the illustrated embodiment, the armour 18 of the cables is connected at the splices to

serve as electrically connected tone conductors.

**Page 6, paragraphs 2 and 3, lines 6 to 15 insert the following paragraphs:**

At an inner end of the backbone cable is a tone source or transmitter 24 that applies a tone signal or oscillating current of a predetermined frequency to the tone conductor. This is transmitted down the conductor to a termination 26 at the outer end of each of the cables.

The transmitter 24 generates ~~a~~ the tone and transmits it on the cable system including the backbone cable 12 and the branch cables 14. The terminations, cable faults and cable capacitance to ground ~~load down~~ attenuate the amplitude of the signal. ~~Loading~~ The amplitude of the signal is important because the current that flows generates a magnetic field which is radiated around the cable. This radiated field is not blocked by the surrounding soil and is readily detectable several metres away. The locating receiver has a coil that is excited by the magnetic field and converts the field back into an electrical signal.

**Page 7, paragraphs 2 to 3, lines 13 to 25 insert the following paragraphs:**

The load of each of the terminations 26 must draw the minimum required location current regardless of the input voltage or tone frequency. The electrical schematic of each termination is illustrated in Figure 3. As shown in that drawing the termination has input terminals 28 and 30. Terminal 28 connects to the tone conductor of the cable while terminal ~~32~~ 30 is connected to a ground return path. A ~~lighting~~ lightning protection surge suppressor 32 is connected to the incoming signal wires to protect the termination from lightning.

The output terminal of the surge suppressor leads to a high pass filter 34 in the form of a large capacitor C1. Other equipment in the cable system may be connected to the cable sheath which is acting as the tone conductor and may apply a signal current thereto. This equipment generally operates to apply signal currents at very low frequencies, much below the frequency of the locating tones. The high pass filter 32 prevents interference with the other functions of the tone conductor so that ~~when the locate tone is not applied~~, the termination will not ~~load down~~ discharge the signal currents of the other functions on the cable.

**The paragraph bridging pages 7 and 8, page 7, paragraph 4, line 26 and page 8, paragraph 1, lines 1 to 10, insert the following paragraph.**

In series with the surge suppressor 32 and the high pass filter 34 is a band stop filter 36. The tone conductor typically has induced AC voltages from power lines at significant ~~levels~~ amplitudes relative to the amplitude of the ~~locate~~ tone current. These induced voltages are also ~~loaded~~ discharged by the termination and add to the drawn current. If the induced voltages are large enough, they cause the current to limit at the minimum locating current. If a tone signal arrives at the termination with the current already limited, there will be no current draw at the tone frequency. If current is not drawn at the correct tone frequency, the locating receiver will filter away the signal from the current that is drawn from the induced voltages and will not be able to find the cable. The band stop filter 36 includes an inductor L1 and a capacitor C2 connected in parallel. The inductance and capacitance are calculated as follows:

**Page 8, paragraphs 2 and 3, lines 11 to 24 insert the following paragraphs:**

At the design frequency, normally 60hz or 50hz depending on the local mains frequency, the impedance of the inductor is equal and opposite to that of the capacitor. The currents are 180° out of phase and cancel each other out. For lower frequencies, the inductor shorts out the capacitor and for higher frequencies the ~~inductor~~ capacitor shorts out the inductor.

In series with the surge suppresser ~~34~~ 32, high pass filter 34 and band stop filter 36 is a rectifier 38. This is a diode bridge composed of four diodes D1 to provide a full wave rectification of the AC tone signal applied to the terminals 28 and 30. The output of the rectifier 38 is connected to a series circuit including a load impedance 40 and an active component 42. The load impedance 40 is a resistor R1, while the active component is a field effect transistor Q1 with the gate and source terminals connected across the resistor R1 and its drain terminal connected to the rectifier 38. The full wave rectifier 38 is employed in this embodiment because the constant current regulator is a DC device and the incoming tones are AC.

**Page 9, paragraph 4, lines 12 to 18 insert the following paragraph:**

The resulting current wave form is shown in Figure 2. It will look like the tone signal with the peaks chopped off because the current increases with the input tone voltage until the set current limit. The current stays at the limit until the tone input voltage comes back down. ~~With~~ Thus, with a strong tone signal near the beginning of the cable, the current waveform will approach that of a ~~sign~~ square wave. A square wave ~~of current~~ is acceptable and is detectable by the tone receiver because the tone receiver locating the cable will filter harmonics and only detect the fundamental frequency.

In the Abstract:

**Page 16 paragraph 1, lines 1 to 11 insert the following paragraph:**

A constant current termination is provided for cable locating tones on communication and control cables that may be buried or placed in underground duct structures. The constant current termination limits the current on each branch of the cable to that required for cable location, thus ensuring that branches furthest from the tone source have adequate current for location purposes. The termination is the same for each branch, regardless of its position along the cable system. This eliminates the need to calibrate and recalibrate termination distances for a cable on installation and when branches are added. It also allows the location of damaged cables where the tone signal strength on a damaged ~~brat~~ branch is less than that for which the termination was designed.